Trust and reciprocity in incentive contracting

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"Homer, the key to worker motivation is trust."
Hank Scorpio, CEO Globex Corporation

"Behold! The greatest breakthrough in labor relations since the cat o' nine tails."
C. M. Burns, Owner, Springfield Nuclear Power Plant

Abstract

Principals can attempt to get agents to perform certain actions preferable to the principal by using *ex post* punishments or rewards to align incentives. Field data is mixed on whether, and to what extent, such informal incentive contracting (paradoxically) crowds out efficient solutions to the agency problem. This paper explores, via a novel set of laboratory experiments, the impact of *ex post* incentives on informal contracts between principals and agents in bargaining environments in which there are gains from exchange and when there is an opportunity for the principal to relay a no-cost demand of the division of those gains. Incentive contracting in these environments does not crowd-out off-equilibrium cooperation, and at high incentive levels cooperation is crowded in.

JEL Classification: C91, C70, D63, D81

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1 Introduction

A key feature of many bilateral bargaining situations is that they involve one party (the principal) enlisting the other (the agent) to affect some action for a fee. Delegating the action by trusting the agent is costly to the principal, but there are potential joint gains from delegating—and it is the agent's action that determines the distribution of those gains. There may be many actions open to the agent, and the principal and agent may value the outcomes of each such action differently. In particular, the action the agent most values may be the least-valued alternative to the principal. Since there is no guarantee that an agent will take the principal's most valued action, a principal can try to get the agent to perform certain actions and not others by structuring incentives in the right way—i.e., by imposing an *ex post* punishment or reward. The interesting economic issue is to find out what ways of structuring incentives are efficient: Should principals try to mitigate the agency problem by appeal to explicit rewards and punishments, and if so, what *size* of carrots and sticks work best? Or, does such explicit incentive contracting (paradoxically) destroy the seemingly robust natural tendency of agents to reciprocate trusting behavior, crowding cooperation out?

Concrete examples of principal–agent relationships like this are easy to find. One such example is the interaction between firms and workers. Both parties have an interest in a workplace in which each trusts the other—the firm, in particular, has an interest in high-worker productivity with little shirking and low monitoring costs. A second example is in the interaction between shareholders and CEOs. Notoriously, in recent years shareholders of large corporations have enlisted CEOs who have chosen actions to the detriment of the company but have nevertheless reaped lucrative severance packages for themselves. While sometimes these incentives are pre-committed (e.g., stock options and performance-based incentives in sports contracts), often they are *ex post*—agents know that some incentive *may* be enacted, but whether the principal rewards or punishes is a decision made *after* the agent performs the delegated action. This is the standard, for instance, in the distribution of year-end bonuses and (in New York schools) the assignment of lunchroom duty to under-performing teachers.[1] The presence of *ex post* incentives on principal–agent relationships—what we might call "incomplete contracts"—are the focus of this paper.

Although there is field evidence suggesting that carrots and sticks do align incentives (Yamagishi, 1988; Groves, Hong, McMillan, and Naughton, 1994; Fernie and Metcalf, 1996; Prendergast, 1999; Lazear, 2000; Fernie and Metcalf, 2000; Ensminger, 2001), there is also a considerable body of work suggesting that, paradoxically, making incentives explicitly tied to performance *erodes* an agent's intrinsic motivations with an overall net effect of decreased efficiency (Deci, 1971; Lepper and Greene, 1978; Deci and Ryan, 1999; Gneezy and Rustichini, 2000a; Benz, Kucher, and Stutzer, 2002). In managerial circles, this is known as the "Paradox of Organizational Trust" (Barnes, 1981; Kohn, 1993): by showcasing carrots and sticks, managers signal that they do not trust their employees to perform well on their own, and this undermines the goal of cooperation. This substitution effect is also known within economics as "motivation crowding out" (Frey, 1997). With field data, it is difficult to vary parameters in a systematic way to separate the effects on trust due to incentive schemes, as most settings have both. The laboratory is useful here since it allows us to systematically vary the parameters and environments to help illuminate the paradox.

This paper systematically investigates incentive contracting under a novel set of laboratory conditions. First, I extend the investment game (Berg, Dickhaut, and McCabe, 1995) by allowing principals to state their (cheap-talk) expectations of the agents, forming a contract with them. Second, I add an *incentive stage* to the game during which agents can be either punished or rewarded, conditional on whether they shirked or fulfilled the terms of the (cheap-talk) contract. In particular, I consider two kinds of incentive environments: environments in which principals may punish under-performing agents (P ONLY), and environments in which principals may reward adequately and over-performing agents (R ONLY). Third, in the incentive stage, I investigate both *low* incentive environments (with a 1:1 exchange rate for rewards/punishments) and *high* incentive environments (with a 1:3 exchange rate for

[1] The first example is nicely illustrated in Ensminger (2001), where Orma herders who perform well receive substantial rewards—in the form of one cow per year. The second example is due to Andreoni, Harbaugh, and Vesterlund (2003). The relevant point is that these are examples of *ex post* imposing of incentivizing devices.

rewards/punishments).[2]

This set of conditions is importantly different from previous work for at least three reasons. First, there is an existing body of work that systematically investigates the impact of the availability of punishments and/or rewards in, for example, ultimatum and proposer–responder games (Andreoni, Harbaugh, and Vesterlund, 2003; Büchner, *et al.*, 2003; Gneezy, 2003). Yet there are no gains from exchange in these contexts, and that is an important feature of the kinds of real-world principal–agent problems we find interesting. Second, much is known about the impact of cheap-talk in coordination settings and in ultimatum games (Cooper, *et al.*, 1989, 1992; Clark, *et al.*, 2000; Duffy and Feltovich, 2002; Boles, Croson, and Murnighan, 2003; Blume and Ortmann, in press).[3] However, the issue of how cheap-talk interacts with both the ability to punish and the ability to reward in trust settings—like those involving workers and firms where such talk is highly likely to occur—is under-explored. Third, this is the first paper to investigate how such cheap-talk contracts, in a game with gains from exchange, and the *levels* of both punishments and rewards that are costly interact with efficient, cooperative behavior.[4] This is significant since, in general, it may be easy and cheap for a principal (e.g., a firm) to impart a significant (relatively speaking) reward or punishment upon on an agent (e.g., a wage employee).

The most closely related experiments are those testing the role of incentives in an efficiency wage game (Fehr, Gächter, and Kirsteiger, 1997; Fehr, *et al.*, 1998; Fehr and Gächter, 2000b; Fehr and Fischbacher, 2002). [5] However, there are several key differences between these earlier experiments and the research reported here. These early experiments were conducted single-

[2]The messages sent by principals are, strictly speaking, cheap-talk (in the sense of Crawford and Sobel (1982)) only in the baseline environment defined below—in that environment the messages have no direct payoff implications. However, once we consider environments with the incentive stage, the contents of the messages may have payoff implications since it will be on the basis of the terms in the message that a principal has the opportunity to impose *ex post* rewards/punishments. But the promises and threats carried by the message will still be incredible. Rather than change what we call the message between the environments, I will stretch standard terminology a little and continue to call such contracts "cheap-talk" contracts throughout.

[3]See Crawford (1998) for a review in coordination games.

[4]Fehr and Rockenbach (2003) and Fehr and List (2004) experimentally examine how only one level of *pre-committed* punishment interacts with transfers and returns in an investment game. Moreover, punishment was *costless* to the principal.

[5]Bohnet, Frey, and Huck (2001) explore the relationship between trust and reciprocity and the degree of contract enforcement in a trust game. Lazzarini, Miller, and Zenger (2003) examines experimentally how a principal's choice to enter an incentive contract when playing a trust game interacts with the probability of continuation with the agent as well as the cost of enforcement.

blind, and there is some experimental evidence suggesting that this procedural difference can significantly increase cooperation in these settings (Rigdon, 2002). The experiment reported here was run double-blind; thus any movement toward cooperation induced by changes in the incentive scheme under these more extreme conditions of social distance is therefore a comparatively stronger result. Additionally, the earlier experiments do not explore the effects of changing the relative costs of punishment and reward, which—as the results reported here suggest—is an important determinant in whether or not cooperation is crowded in. Most importantly, the efficiency wage game investigations only include a systematic examination of a strong-reciprocity treatment—both *ex post* punishment *and* reward are possible—where the largest benefits to cooperation have been estimated (see Andreoni, Harbaugh, and Vesterlund, 2003). The experiment here, on the other hand, systematically investigates varying levels of *ex post* punishment and reward independently, aiming to isolate the effects of each incentive mechanism on cooperation in environments with incomplete contracts.

The rest of the paper is organized as follows. Section 2 puts forward the implicit and incentive contracting environments. Section 3 discusses the experimental design and Section 4 presents the results. A significant benefit to studying bilateral bargaining experimentally is that the control of the laboratory can be marshaled to better understand the gender differences we see in bargaining situations in the real world. Thus the results section also explores how incentive contracting may differentially impact male and female principals and agents. Section 5 provides final remarks.

2 Contracting Games

We first consider a simple extension of the investment game (Berg, *et al.*, 1995). The investment game is a two-person bargaining game, where the principal or Player 1 (P1) is paired with the agent or Player 2 (P2), and are endowed with M_1, M_2 (respectively), where M_1^* is some investable portion of M_1. In the first stage, P1 can send some, all, or none of M_1^* ($0 \leq X \leq M_1^*$) to P2; any amount sent is multiplied by some factor (growth rate) $r > 0$. In the second stage, P2 can return some amount Y of rX to P1. The payoff to P1 is

$(M_1 - M_1^*) + (M_1^* - X) + Y$ and the payoff to P2 is $M_2 + rX - Y$. If players are only concerned about their own material well-being and there is common knowledge of opportunism, then any amount P2 receives, she will keep. So P1, knowing this, sends \$0 dollars. This is the unique subgame-perfect equilibrium: P1 earns M_1 and P2 earns M_2. However, behavior by P1s *and* P2s does not match this prediction. In fact, when $M_1 = M_1^* = M_2 = \$10$ and $r = 3$, 30 of 32 P1s send money (\$5.16 on average) and investments of \$5 had an average payback of \$7.17.[6]

We focus on environments where $M_1 = 20, M_1^* = 10, M_2 = 10$, and $r = 3$. The asymmetry in endowments between P1 and P2 will give P1 resources for imposing *ex post* punishments and rewards in the incentive contracting games defined below.

2.1 Implicit Contracting Game

To more closely resemble our motivating principal-agent situation, the investment game is extended in two ways. The resulting environment is the *implicit contracting game* (Figure 1). First, in addition to specifying an amount X ($0 \leq X \leq M_1^*$) to be invested in P2, P1 proposes a division of the gains from exchange, Z and $3X - Z$, where Z is the amount P1 wants returned and $3X - Z$ is the amount suggested for P2 to keep. In short, the principal can send a cheap-talk message to the agent. Second, P2 has the opportunity to accept or reject P1's transfer and proposed division. If P2 rejects the offered contract, P1 earns 20 and P2 earns 10 (i.e., the outside option). On the other hand, if P2 accepts the offered contract, P1's endowment is decreased by X and P2's increased by $3X$. Then P2 decides on a final allocation; that is, she selects some amount Y of $3X$ to return to P1, keeping $10 + 3X - Y$ for herself. Note that the *actual* distribution of the gains from exchange $(Y, 3X - Y)$ may be different from P1's *requested* distribution of those gains $(Z, 3X - Z)$ signaled in the first stage. In this game, if P2 does not fulfill the contract, there are no financial consequences faced by P2.

[6]There are results from binary-choice trust games demonstrating experimental subjects exhibit significant amounts of trust and reciprocity (McCabe and Smith, 2000; McCabe, Rigdon, and Smith, 2002b; Eckel and Wilson, 2004). For other related games on trust, see Croson and Buchan (1999), Glaeser, Laibson, Scheinkman, and Soutter (2000), Scharlemann, Eckel, Kacelnik, and Wilson (2001), McCabe, Rigdon, and Smith (2002a);

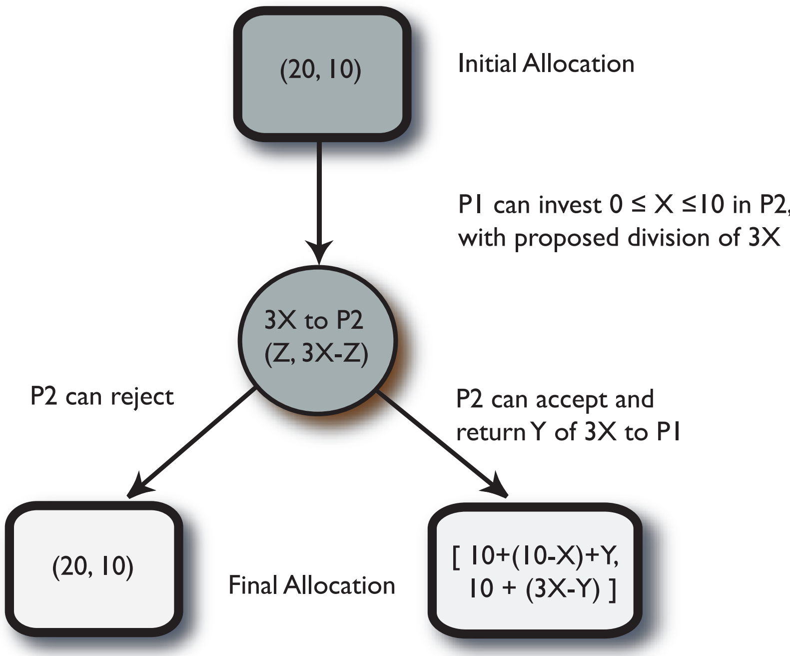


Figure 1: Implicit Contracting Game

There are two subgame perfect strategy profiles in the implicit contracting game, both determining the final allocation of \$20 for P1 and \$10 for P2. If P1 and P2 are utility maximizers and have a strictly increasing utility for money, then for any value of $X \neq 0$, P2 has a dominant strategy to accept the offered contract and keep $3X$, returning 0 to P1; thus a utility maximizing P1, knowing that P2 is also a utility maximizer, will choose $X = 0$. Therefore, P2 is indifferent between accepting and rejecting the offer; in either case, the outcome will be (20, 10).

This solution is inefficient. This naturally leads to asking how we can do better. When there are gains to be had from exchange, what mechanism—implicit contracting or incentive contracting—provides the agent with the greatest incentive to follow through on the contract with the principal? Is there any evidence for the Paradox of Organizational Trust—does incentive contracting crowd out cooperation? If carrots and sticks turn out to be more efficient devices than implicit contracts, does their relative size matter?

Bohnet and Zeckhauser (2004), and Slonim (2004); see Camerer (2003) for a review.

2.2 Incentive Contracting Games

An implicit contract is an offered contract of an investment amount X and a proposed division Z. But the proposed division by P1 is not enforceable, and so P1 performs a purely trusting action when investing X in P2. P1's decision of how much to invest in their counterpart determines the gains from exchange, and Z represents how P1 wants those gains to be redistributed back. However, P1 is unable to either punish or reward P2 for shirking or meeting the terms of the accepted contract. Incentive contracts, on the other hand, endow P1 with punishment and reward options conditional on P2's behavior. There are two broad categories of incentive contracts: those in which the principal only has the enforcement option of punishing the shirkers (PUNISH) and those in which the principal only has the enforcement option of rewarding the trustworthy (REWARD). For instance, many firms use year-end bonuses as a reward strategy, and many universities use annual salary raises for both reward and punishment of faculty—a low raise for punishment and a high raise for rewards.

To implement incentive contracting into the general framework, we add a *third stage* to the implicit contracting game. The resulting games—we discuss two kinds—are incentive contracting games. In the third stage, upon observing P2's action, P1 can reward or punish depending on whether or not the action matches the accepted contract.

Rewards are transfers which are either neutral or efficiency enhancing; punishment is utility reducing to both P1 and P2. P2 chooses an action

$$\rho = \lambda c$$

by choosing a value for c where λ is a scalar representing the *impact* of the incentive and c ($0 \leq c \leq M_1 - M_1^*$) is the *cost* to P1 of enforcing the incentive. In our games, $M_1 - M_1^* = 10$. The resources for enacting a punishment/reward is given by the endowment less the investable portion. Hence, the resources for imposing incentives is independent of the amount invested by P1 and is independent of the amount returned by P2.

We vary the value of λ along two dimensions: positive/negative and high/low. ρ is a *reward* if λ is positive, a *punishment* if it is negative; ρ is a *high incentive* if $|\lambda|$ is large, a *low incentive* if it is low. We focus on λ taking values from $\{\pm 1, \pm 3\}$. When a punishment or reward is enacted, ρ is added to P2's final allocation and c is subtracted from P1's.

In the REWARD variants of the incentive contracting games, P1 has the option of rewarding P2 if the amount returned is greater than or equal to the request (i.e., if P2 follows through on the accepted contract: $Y \geq Z$). The two REWARD games are Low and High. In Low Reward, P1 can spend 1 to increase P2's earnings by 1 ($\rho = 1c$). In High Reward, P1 can spend 1 to increase P2's earnings by 3 (i.e., it is relatively cheap for P1 to reward P2: $\rho = 3c$).

In the PUNISH variants of the incentive contracting game, P1 has the option of punishing P2 if the amount returned is less than the request (i.e., if P2 deviates from the accepted contract: $Y < Z$). Punishment is utility-reducing to both parties. The two PUNISH games are Low and High. In Low Punish, P1 can spend \$1 to reduce P2's earnings by \$1 ($\rho = -1c$). In High Punish, P1 can spend 1 to reduce P2's earnings by 3 (i.e., it is relatively cheap for P1 to punish P2: $\rho = -3c$).

The incentive contracting games provide a mechanism for P1 to align the incentives of P2. But these mechanisms are costly—if these games are played between utility maximizers (with the usual common knowledge assumptions) there will be no demand by P1 for either punishment or reward, the proposed divisions are indeed cheap-talk, and the subgame perfect equilibria remain unchanged.

The aim here is to see how adding this third stage impacts the cheap-talk messages and whether it will crowd out or crowd in transfers and returns.

3 Experimental Design and Procedures

The experimental design consists of five treatments: in each treatment subjects play one of the contracting games. The baseline is the implicit contracting game, or TRUST. There are two low incentive treatments, LOW REWARD and LOW PUNISH, where there is a \$1: \$1 exchange rate for rewards ($\lambda = +1$) or punishments ($\lambda = -1$). There are two high incentive treatments, HIGH REWARD and HIGH PUNISH, where there is a \$1: \$3 exchange rate for rewards ($\lambda = +3$)

or punishments ($\lambda = -3$). The cost of enforcing an incentive mechanism, c, is constrained by and deducted from P1s \$10 show-up fee (i.e., $M_1 - M_1^*$). The design is implemented across-subjects; subjects are randomly allocated to one of the treatments. The goal is to vary the enforcement device and examine the impact on behavior and efficiency achieved between principals and agents.

The experiments were run at the Harvard Business School's Computational Laboratory for Experimental Research with undergraduate students from universities in the Boston area.[7] The sessions were run January 2004 through June 2004. Subjects who had previously participated in similar experiments were excluded. The participants played the game once and only once, and this fact was common information. Sessions had twelve to twenty-eight subjects and took less than 1 hour to complete. Each participant received \$10 for showing up on time. Participants in the role of P1s were allocated an additional \$10 for the decision task. The average earnings were \$20.65 for P1s and \$22 for P2s, and varied from \$1 to \$45.

The only difference in the instructions for the treatment conditions was in the description of the third stage (see Appendices A and B). The instructions for reward (R ONLY) indicated that if the amount returned was equal or greater than that requested, P1 would have the option of increasing the earnings of P2; whereas the instructions for punish (P ONLY) indicated that if the amount returned was strictly lower than that requested, P1 would have the option of decreasing the earnings of P2.

The experimental protocol for all treatments was double-blind as in Berg, *et al.* (1995).[8] To implement this, subjects drew a blank envelope prior to the start of the experiment containing a code and entered it into their computer. Subjects retrieved their final earnings anonymously by sliding their envelope containing the code under a door, the experimenter looked up the code, placed their earnings in the envelope, and slid the envelope back under the door to them. As they exited the laboratory, a monitor, chosen from the subject pool before instructions were given, had each participant sign an earnings receipt.[9] Additionally,

[7] Data are available from the author at request.

[8] The protocols differ in implementation—the sessions reported here were computerized, and the Berg *et al.* sessions were hand-run—but both ensure complete (double-blind) anonymity.

[9] The monitor was paid \$20 for the task.

	Trust	**Low Reward**	**High Reward**	**Low Punish**	**High Punish**
Transfer ($)	5.45 (3.90)	6.68 (3.31)	6.53 (3.92)	6.41 (4.10)	7.37* (3.71)
Desired Payback (%)	46.97 (14.58)	50.73 (13.43)	56.68* (21.40)	51.05 (13.49)	47.93 (11.60)
Actual Payback (%)	29.58 (21.15)	31.13 (21.76)	47.16* (34.35)	31.81 (21.11)	39.33* (19.2)
Total Pairs	38	34	34	38	30

Standard deviations in parentheses; *significantly different from TRUST ($p < 0.05$)

Table 1: Comparison of Trust with Incentive Conditions

the monitor had the task of collecting the codes and placing them in an appropriately labeled box "male" or "female". Using this process, the experimenter is unable to match individual decisions with a particular person; yet collection of gender information on the subject pool was possible.

4 Results

Table 1 reports for all conditions the average transfer by P1 to P2 (X), the average percentage of the gains P1 requested be returned ($\frac{Z}{3X}$), the average actual percentage returned by P2 ($\frac{Y}{3X}$), and the total number of pairs (N). The first line shows that the same amount of money relative to the TRUST condition is transferred by P1 in all treatment conditions, except significantly more money is transferred in the HIGH PUNISH condition ($p = 0.05$).[10] Figure 2 graphically displays the distribution of transfer amounts. The proportion of P1s sending $0—roughly 20%—is higher in the implicit contracting game than in the standard investment game, where 6.25% send $0 (Berg, *et al.*, 1995). Although the proportion obtained in a replication study by Ortmann, Fitzgerald, and Boeing (2000) found 18.75% sent $0, which

[10]Unless otherwise noted, reported test statistics are based on the Mann-Whitney non-parametric test for difference in medians. All tests reported use a two-sided alternative. Using the Kolmogrov-Smirnov non-parametric test for equality of distributions does not change the statistical results.

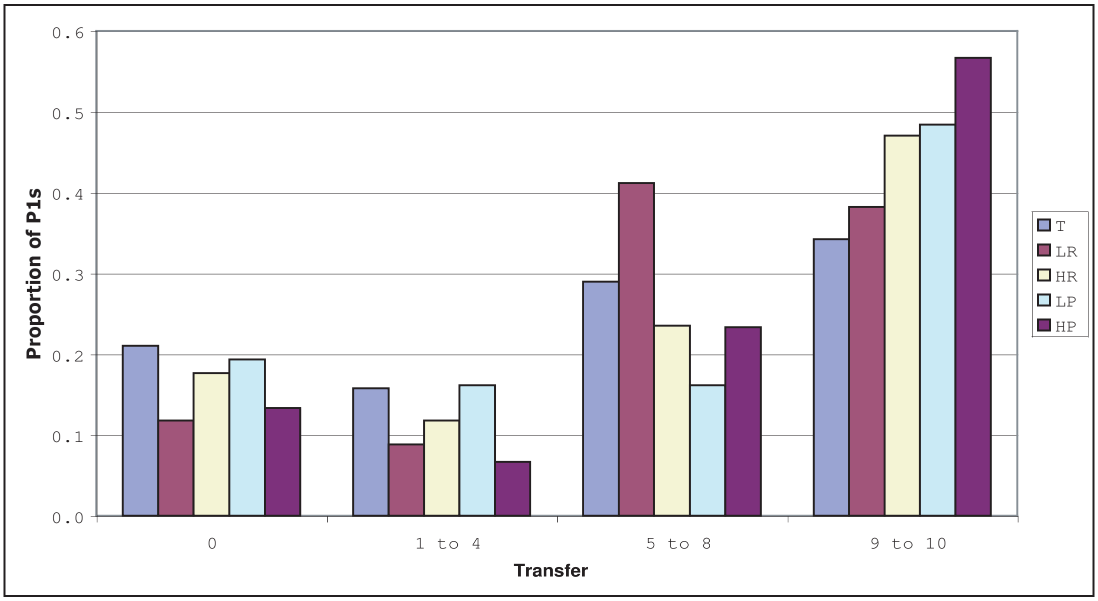


Figure 2: Transfers Across Treatments

is much closer to these data. The proportion of P1s sending \$10—more than 30%—is also higher in the implicit contracting game than in the standard investment game, where 15% (Berg, *et al.*, 1995) and 18% (Ortmann, Fitzgerald, and Boeing, 2000) send \$10. The addition of \$10 to P1's starting capital seems to increase both the number of P1s who keep all of their endowment and the number who pass on as much as possible. Figure 2 also reveals that the largest proportion of P1s investing the maximum amount in P2—57%—occurs when there is a potential for relatively inexpensive retribution by P1 (i.e., under High Punish).

Desired payback is P1s cheap-talk message, which provides an opportunity for P1 to make expectations clear. The second line in Table 1 shows $\frac{Z}{3X}$, the percentage of the gains P1 requested returned from P2. On average, the desired payback is roughly 50% in all conditions, except a significantly larger request is made by P1 in the High Reward condition than in the Trust condition ($p = 0.0388$). Under High Reward, where P1 has the opportunity to inexpensively positively reciprocate if P2 follows through on the accepted contract, P1 places significantly *higher* demands on P2.

Beyond the means reported in Table 1, we can look at the distribution of the cheap-

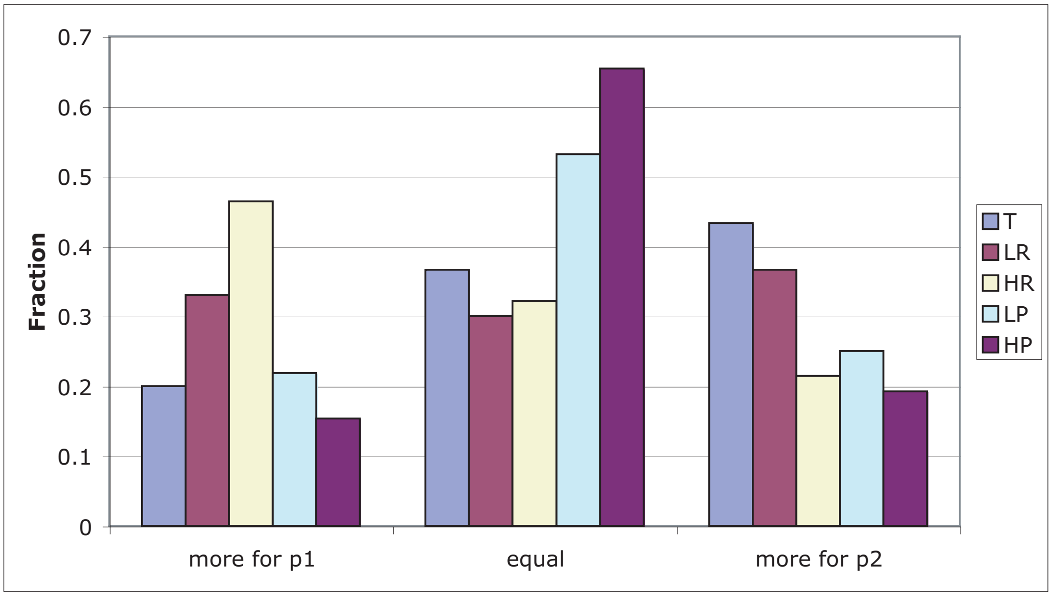


Figure 3: Desired Payback: All Treatments

talk messages. Figure 3 plots the fraction of P1s who request a larger share of the gains for themselves (more for P1), an equal share (equal), and those who request a smaller share of the gains for themselves (more for P2).[11] There is a spike in the more for P1 category under High Reward and also a spike in the equal category under High Punish. Figure 4 displays how these requests translate into desired final earnings. Given that P1 begins with an additional \$10, if he wants to equalize final earnings, the desired payback request will have to differ conditional on the amount sent. For example, if P1 transfers \$3, then the desired payback would only request 11% of the gains from exchange; if P1 transfers \$7, then the desired payback would request more of the gains be returned, 39%; only if \$10 is transferred should the request by P1 be to split the gains equally at 50%. In the two punish conditions, P1s more frequently want to equalize final earnings: they are most equitable toward their agents when only punishment is available as a means of enforcement and do not show this taste for equalizing final distributions when relying on rewards or (purely) implicit contracts—in these

[11]Putting P1's desired share of $3X$ on the x-axis and P2's on the y-axis, these labels pick out the regions below, along, and above the 45 degree line. The distributions for the individual treatments are reported in Appendix C. Figure 3 summarizes those.

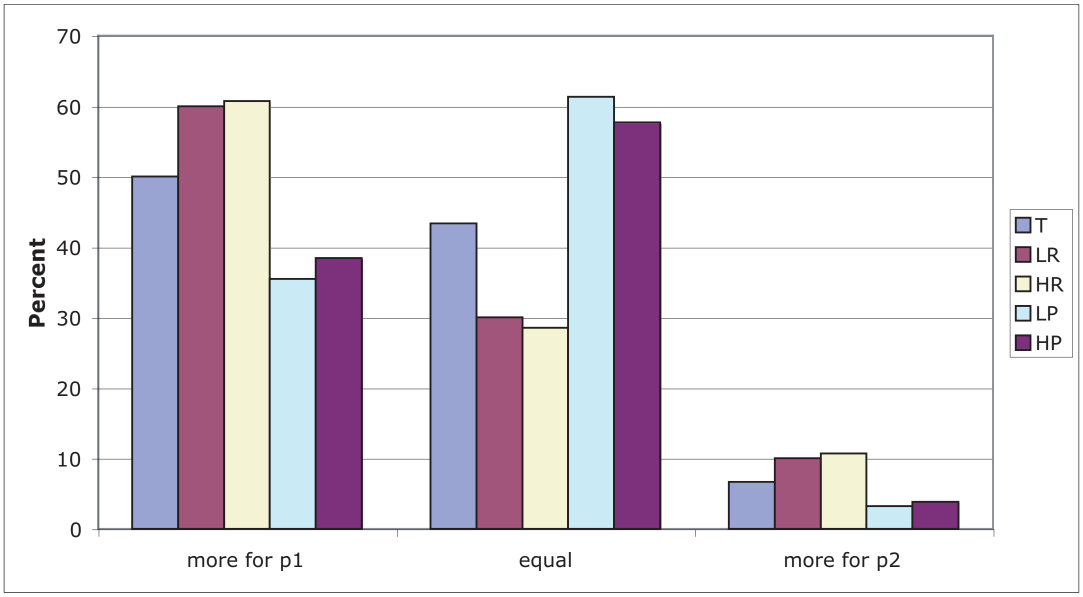


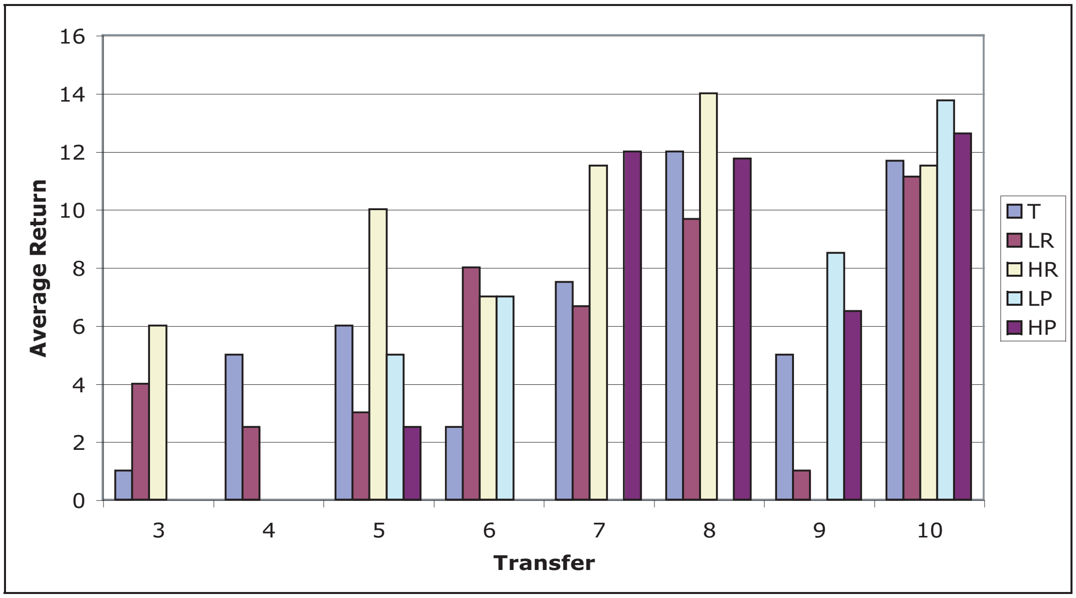
Figure 4: Desired Share Earnings: All Treatments

environments P1s get greedy.[12] This is somewhat surprising as it would be natural to expect P1s to request higher final earnings for themselves when it is common information that they have the option to punish should that request not be met; instead under P ONLY mechanisms is where principals try to equalize earnings.

4.1 Player 2s' Behavior

How do P2s respond to the cheap-talk message sent by P1s and the availability of rewards or punishments across the conditions? Figure 5 shows the amount of $3X$ returned by P2 conditional on the amount sent (X). The average amount returned in HIGH REWARD and HIGH PUNISH is significantly higher than under TRUST ($p = 0.0484$ and 0.0177). Note that, like in the investment game, it *never* pays to send \$1 or \$2 in *any* of the contracting games. Moreover, it pays on average in all of the treatments to invest as the average return is larger than the average amount sent. Additionally, the returns on investment correlate positively with the investment level, suggesting that agents are responding reciprocally as the investment

[12] $p \leq .05$ using a difference in proportions test



*The average returns are: \$6.8 (T), \$7.3 (LR), \$11.8 (HR), \$8.7 (LP), and \$10.9 (HP).

Figure 5: Returns Across Treatments Conditional on Amount Sent

level increases.[13]

The third row in Table 1 shows $\frac{Y}{3X}$, the mean actual percentage of the gains returned by P2 to P1. P2 returns a significantly *larger* percentage in the two high incentive conditions, HIGH REWARD and HIGH PUNISH, than under TRUST ($p = 0.0367$ and 0.05).[14] Finally, comparing the actual share of the gains $\frac{Y}{3X}$ (row 3) with the desired share of the gains $\frac{Z}{3X}$ (row 2) by treatment, we see that P1s ask for more than they receive—*except* in HIGH REWARD and HIGH PUNISH. In these high incentive environments, the demands of the cheap-talk message are met: $\frac{Y}{3X}$ and $\frac{Z}{3X}$ are *not* significantly different ($p = 0.259$ in HIGH REWARD and $p = 0.114$ in HIGH PUNISH).

To examine the degree of positive reciprocity exhibited by P2s across the treatments, we

[13]The pairwise correlation coefficients for amount sent and amount returned are 0.68 (T), 0.49 (LR), 0.48 (HR), 0.74 (LP), and 0.47 (HR), which are all significant at $p < .01$.

[14]The average proportion returned under TRUST is slightly higher, but consistent with both Berg, Dickhaut, and McCabe (1995) and Buchan, Johnson, and Croson (in press)—18% and 22% respectively.

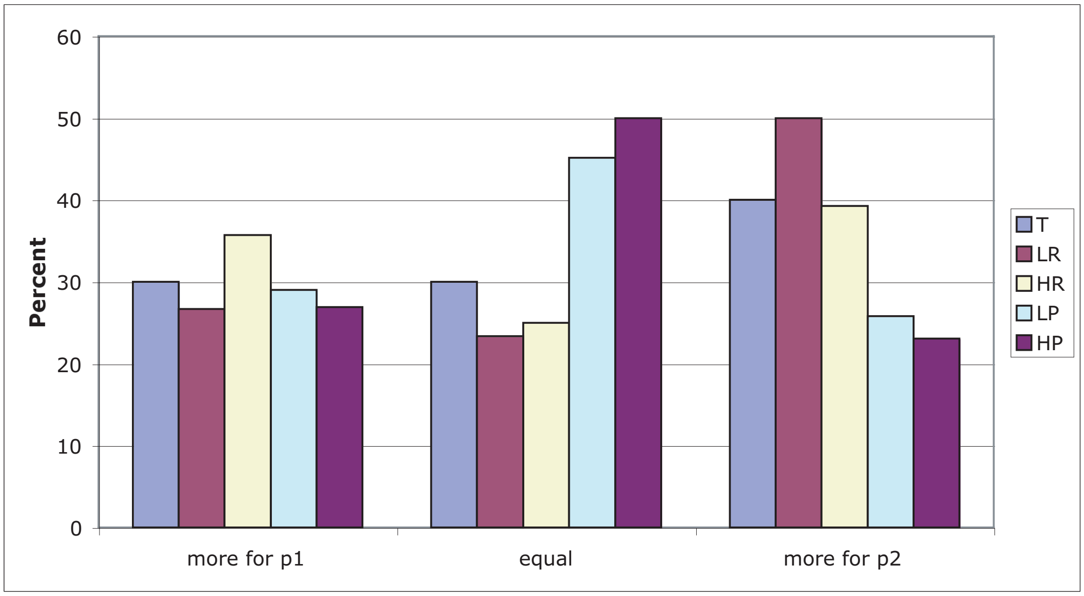


Figure 6: Actual Share Earnings: All Treatments

estimated the following logit regression separately for each treatment:

$$\ln \frac{p(t)}{1-p(t)} = \alpha + \beta\, \mathsf{SHARE}_{\mathsf{P2}} + \gamma\, \mathsf{GENDER}_{\mathsf{P2}} + \epsilon$$

where $p(t)$ is the probability P2 fulfilled the terms of the cheap-talk message in Round 1, and $1 - p(t)$ is the probability that P2 shirked on the terms specified by P1. The independent variables are $\mathsf{SHARE}_{\mathsf{P2}}$, which is the amount of the gains from exchange P1 offered to P2 in the cheap-talk message (i.e., $3X - Z$), and $\mathsf{GENDER}_{\mathsf{P2}}$, which is a dummy variable capturing the gender of P2 with a value of 1 for females, 0 for males. See Table 2 for the results. The columns report the logit odds ratio coefficient estimates and p-values. For all treatments, $\mathsf{GENDER}_{\mathsf{P2}}$ is insignificant in determining the likelihood that the contract is fulfilled. Also notice that in each treatment, except High Punish, for every \$1 increase in the amount of the gains from exchange offered to P2, the odds of the contract being fulfilled increases by a statistically significant amount. Together these results suggest that as P1 is more generous to P2 in the first stage of the contracting game, P2 is much more likely to reciprocate by fulfilling the terms of the exchange in the second stage. However, this is not the case only

	Trust	**Low Reward**	**High Reward**	**Low Punish**	**High Punish**
$\mathsf{SHARE}_{\mathsf{P2}}$	1.34* (0.015)	1.32* (0.05)	1.23* (0.025)	1.38* (0.014)	1.23 (0.098)
$\mathsf{GENDER}_{\mathsf{P2}}$	1.38 (0.744)	4.83 (0.10)	3.13 (0.275)	.905 (0.908)	.844 (0.847)
$LR\ \chi^2$	11.35*** (0.0034)	12.86*** (0.0016)	9.68*** (0.0079)	13.29*** (0.0013)	3.49 (0.1743)
pseudo R^2	0.2434	0.3092	0.2643	0.2901	0.1008

p-values in parentheses; p-values: $^* \leq 0.05$, $^{**} \leq .01$, $^{***} \leq .001$

Table 2: Determinants of the Probability of P2 Fulfilling Contract

in High Punish—the likelihood P2 follows through on the contract is not influenced by the distribution of the gains offered by P1.

4.2 Summary of Results: First Two Stages

Below are the key results from the implicit contracting game and the first two stages of the incentive contracting treatments:

Result 1. *There is little evidence of subgame perfect play in any of the conditions.*

This is unsurprising and consistent with the stylized facts from bilateral bargaining experiments. P1s send \$0 at very low rates: 26.67% in Trust, 11.76% in Low Reward, 17.65% in High Reward, 16.22% in Low Punish, and 13.33% in High Punish.

Result 2. *No crowding out of transfers or returns—low incentives have no impact relative to the baseline.*

Average (and median) transfers are the *highest* in High Punish—\$7.37 and *lowest* in Trust—\$5.45 ($p = 0.040$); average (and median) returns are *highest* in High Reward—\$11.8 and High Punish—\$10.9 and *lowest* in Trust—\$6.8 ($p = 0.0484$ and 0.0177). Moreover, there is not a significant difference between transfers and returns in the low reward/punish conditions and the baseline ($p = 0.2204$ and 0.8060 for Trust *vs.* Low Reward; and 0.252 and 0.2912 for Trust *vs.* Low Punish). The conclusion then is that the incentive treatments do not crowd out transfer or returns.

Result 3. *Carrots and Sticks work the same at low levels, and at low levels work no better than implicit contracts.*

There is no difference between average transfers under Low Reward and Low Punish (\$6.68 *vs.* \$6.41, $p = 0.536$) and also no difference between average returns (\$7.3 *vs.* \$8.7, $p = 0.662$). These levels, moreover, are no different from transfers and returns in the implicit contracting game. If potential reward and punishment levels are low, there is no efficiency advantage to incentive contracts over implicit contracts.

Result 4. *Big Carrots and Big Sticks induce greater efficiency than implicit contracts. Big Carrots induce higher returns; Big Sticks increase investment levels.*

Transfers in High Reward and Trust are no different, but *returns* in High Reward are greater than in Trust. In High Punish, more is transferred and more is returned than in Trust. In fact, High Punish is the *only* environment that generates larger investment levels. Average transfers in High Reward are *lower* than under High Punish (\$6.53 *vs.* \$7.37) and yet, average returns are not different. A natural explanation is that P1s expect P2s, under the threat of a Big Stick, to behave themselves—and so P1s transfer more. On the other hand, P1s do not seem to expect Big Carrots to carry the same motivation as Big Sticks—so they transfer less in High Reward.

Result 5. *Desired payback is largest under Big Carrots.*

In High Reward, P1s ask for a *larger* relative share of gains from exchange (56.68%) than under Trust ($p = 0.0388$) and a weakly larger share than under High Punish ($p = 0.0703$). So P1s make more significant requests of P2s when there is a potential for relatively inexpensive rewards. It looks as though P1s anticipate that P2s will attempt to seek a reward by following through on the request, so P1s choose to ask for more of the gains from exchange.

Putting these two results together suggests an interesting picture about how principals hedge their investments in agents. There seems to be an expectation that Big Sticks motivate better than Big Carrots. P1s transfer more in High Punish—but they hedge their comparatively liberal investment: they ask for *less* of the gains back, *a priori* making it relatively less likely they will have to *use* the Big Stick. (P2 has to keep a lot to qualify for punishment.) In High Reward, on the other hand, P1s hedge their comparatively conservative investment—they ask for *more* of the gains back, *a priori* making it relatively less likely they will have to *use* the Big Carrot. (P2 has to do more to qualify for a reward.) The returns are the same in High Reward and High Punish: the two investment-plus-hedge strategies seem to align P2s behavior to the same extent.

Result 6. *Under Big Carrots and Big Sticks, actual payback is equivalent to desired payback.*

The high incentive treatments are the only treatments where the desired distributional outcome is equivalent to the final distributional outcome ($p = 0.6115$ and 0.172). The level of the incentive matters to the degree to which P2 follows through on the request made by P1 via the cheap-talk message. Since P1s request a greater return under High Reward than High Punish, P1s are better off in the former than the latter.

4.3 Rewards and Punishments

Based on the difference in return behavior by P2s in the high incentive conditions as compared to the baseline, it looks as though she has the expectation that P1 will provide rewards or impose punishment. An interesting question is whether these expectations are met. If players are myopically self-interested, the prediction is that there will be no demand for reward and punishment. Since it is costly for P1 to provide rewards and to impose punishment, if given the opportunity to do so, P1 will choose $c = 0$. Thus $\rho = \lambda 0 = 0$, no matter the value of λ. However, previous experimental results have demonstrated a significant demand for rewards or punishment in different contexts (Andreoni, Harbaugh, and Vesterlund, 2003; Sefton, Shupp, and Walker, 2002; Gneezy, 2003; Fehr and List, 2004). One can imagine that whether or not P1 rewards or punishes will partly depend on (1) the degree to which P2 follows through or deviates from the accepted contract and (2) the relative cost (i.e., the relationship between λ and c). The first line in Table 3 reports the degree to which the amount returned deviates

	Low Reward	High Reward	Low Punish	High Punish
Return – Request ($)	2.27 (2.05)	4.67 (7.8)	-5.67 (4.70)	-7.78 (6.53)
Reward/Punish Cost ($$c$)	0.67 (0.82)	2.22 (3.23)	0.07 (.26)	1 (3)
Implemented (%)	46.67	44.44	6.67	10
Number Obs.	15	18	15	10

Cases where $Y \geq Z$ under Reward and $Y < Z$ under Punish

Table 3: Demand for Reward and Punishment

from that requested for only those cases where P1 had the opportunity to reward or punish, i.e. $Y \geq Z$ in reward environments and $Y < Z$ in punishment environments. In the reward conditions, P2 returns *more* on average than P1 requested and in the punish conditions P2 returns *far less* than P1 requested.

The second line in Table 3 shows at what cost P1s enforce incentives by reporting mean values for c. Under both of the low incentive conditions very little reward or punishment is implemented in the third stage. Yet, in HIGH REWARD, $\bar{\rho} = \$6.50$, more than making up for the (almost) $5 more returned by P2 to P1. However, in HIGH PUNISH, even though P2 are *significantly* under-fulfilling the contracts, punishments are relatively low: $\bar{\rho} = -\$3$. The third line in Table 3 indicates that when the option was available to reward, a significant fraction—almost half—of P1s chose to reward; yet, a significantly smaller fraction made use of the punishment mechanism. In fact, under HIGH PUNISH only *one* individual punished—he initially invested all $10 of his investable endowment, requested a 50/50 split of the gains, but P2 kept all $30 of the gains. So P1 then spent $9 to reduce P2's earnings by $27, erasing nearly the entire original gains from exchange!

4.4 Summary of Results: Third Stage

Below are the key results from the third stage of the incentive contracting treatments:

Result 7. *P1s' demand for Carrots exceeds P1s' demand for Sticks.*

The demand by P1s for Carrots (at any level) far exceeds the demand for Sticks (at any level). When given the opportunity, about 50% of P1s reward their counterpart in both reward treatments by choosing $c > 0$; however, far fewer P1s punish their counterpart—only 6% and 10% choosing $c > 0$ in Low Punish and High Punish, respectively (using a proportion test, $p = 0.0132$ and 0.0615).

Result 8. *When implemented, principals use significantly larger Carrots than Sticks across incentive treatments.*

P1s opted for rewards uniformly greater than punishments. In Low Punish, an average of only \$.07 is imposed on deviating P2s which is significantly lower than the \$.67 reward issued in Low Reward ($p = 0.012$). Similarly for the high-incentive treatments: in High Punish only $\rho = -3(.90)$ is imposed; that is weakly different from the rewards of $\rho = 3(2)$ issued in High Reward ($p = 0.1048$).

4.5 Gender Differences

The evidence on gender differences in the standard investment game seems to be converging: males are more trusting than females (male P1s transfer more than female P2s), but females are more reciprocal than males (female P2s return more than male P2s).[15] There is no research that tracks gender differences in environments like the contracting games considered here in which there are gains from exchange and cheap-talk messages communicating desired distributions of those gains. The analysis sheds light on the degree to which males and females trust and trustworthy behavior can be differentially impacted by the nature of the institutional arrangement between a principal and their agent.

The gender results in the contracting games can be grouped around three variables: investment levels (X), actual relative share of gains ($\frac{Y}{3X}$), and desired relative share of the gains in the cheap-talk message ($\frac{Z}{3X}$).

[15] Croson and Buchan (1999); Chaudhuri and Gangadharan (2003); Buchan, Croson, and Solnick (2003); Harbaugh, Krause, Liday, and Vesterlund (2003). See Eckel and Grossman (in press) for a comprehensive review of gender differences across bargaining games. Differences in this choice behavior are often attributed to risk preferences. See Charness and Gneezy (2004) for a meta-analysis and systematic experimental examination on gender and risk. Their findings confirm the common assumption that women are more financially risk averse than men. Chaudhuri and Gangadharan (2003) correlate risk preference with decisions in the investment game.

Investment levels in Trust, Low Reward, and Low Punish, are gender invariant ($p =$ 0.329, 0.3329, and 0.6302). Given the standard gender differences in the investment game, this suggests that the cheap-talk messages differentially affect choice behavior of P1s across genders—after all, the only salient difference between the implicit contracting game and the investment game is the cheap-talk message. However, there are significant differences in behavior in the high incentive conditions, females investing significantly less than males in both High Reward and High Punish. Moreover, this difference is more exaggerated in High Reward—\$4.94 *vs.* \$8.31 ($p = 0.0074$)—than it is in High Punish—\$6.67 *vs.* \$7.8 ($p = 0.0412$). There are significant increases in efficiency that high incentives bring to the contracting environment. The gender differences suggest that these gains are largely due to increasing investments made primarily by males.

Return behavior as measured by actual relative share returned is gender invariant across all conditions.[16] Again, given the standard gender differences in the investment game, this suggests that the cheap-talk messages differentially affect choice behavior of P2s across genders. In contrast to P1 behavior, the presence of high incentives does not induce any gender difference for returns.

The presence of a cheap-talk message about desired distribution of gains affects choice behavior of both P1s and P2s. A natural question is to ask whether the cheap-talk messages themselves are gender invariant across treatments. Indeed, they are gender invariant across the incentive treatments LR, LP, HR, and HP.[17] However, in the implicit contracting game—the investment game-plus-cheap-talk—there is a significant gender difference in $\frac{Z}{3X}$. Under Trust, females ask for a significantly *smaller* share in the gains from exchange—40% compared to 53% requested by males ($p = 0.05$). So although females invest at the same levels as their male counterparts, females ask for less from their agents.[18] This may be because the

[16] Trust: $p = 0.6324$; Low Reward: $p = 0.1721$; High Reward: $p = 0.1913$; Low Punish: $p = 0.591$; High Punish: $p = 0.2648$. The results are not affected by measuring return behavior by actual amount returned.

[17] Low Reward: $p = 0.7204$; High Reward: $p = 0.4252$; Low Punish: $p = 0.2964$; High Punish: $p = 0.7832$.

[18] This is consistent with the studies reported in Babcock and Laschever (2003). They argue that differences between males and females in salaries, position, benefits, *etc.* can be partially explained by the fact that females simply do not ask for as much as their male counterparts.

implicit contract is seen as a relatively risky environment—there is no means of enforcing the cheap-talk contract—and asking for a smaller relative share of the gains offers some insurance. This difference in negotiation behavior is washed out in the presence of incentives. Depending on how robust these results prove to be in the long run, the institutional implications seem clear.

4.6 General Summary of Results

Overall, the results support four conclusions. First, there is no evidence of a Paradox of Organizational Trust nor any evidence that sanctions (or rewards) have detrimental effects on cooperative behavior. This is in contrast to the results reported by Fehr and Rockenbach (2003). Neither is there any evidence of a "W-effect" of incentives—Gneezy's (2003) finding in the proposer–responder game that low levels of incentives crowd out transfers and high levels crowd them in.[19] Moreover, the results reported here differ from those in Gneezy and Rustichini (2000b), where the effect of incentives on performance on an IQ test and fund raising task is also non-monotonic. Rather, in a game with gains from exchange and cheap-talk contracts, low-level incentives have *no* behavioral effect and high-level incentives crowd *in*. Incentives, at high-levels, are efficiency-enhancing contract mechanisms.[20]

Second, the cheap-talk messages do not vary across games—*except* in HIGH REWARD. The ability to deploy a Big Carrot seems to give P1s a sense of entitlement over the final distribution, and they ask for more of the gains from exchange. Holding the ability to impose a big fine creates no such entitlement. It is an open question what the relationship is between this sense entitlement over a final distribution and the sort of earned entitlement that accompanies property-right manipulations of ultimatum and dictator games (Hoffman, *et al.*, 1994).

Third, it is only in the high-incentive environments that actual relative share of the gains $\frac{Y}{3X}$ equals desired relative share of the gains $\frac{Z}{3X}$. This suggests that P2s behavior in these

[19] A plot with five treatments on the horizontal axis with fines on the left hand side relative to the baseline and rewards on the right hand side, and average offer of proposers on the vertical axis results in a W-shaped graph.

[20] The effect of incentive levels in the contracting games looks more like a "V-effect".

conditions is being driven by different expectations. In particular, it is natural to conclude that agents, in high incentive environments, expect that the incentives will be enacted. It is, after all, relatively cheap to heap a large reward on the dutiful at high levels and cheap to slap a serious fine on shirkers. But these expectations are not uniformly borne out by principals' behavior. Principals will *reward* in high-incentive environments—about half of the time, and at significant levels. But principals only very rarely *punish* in these high-incentive contexts. It is unclear what accounts for this mismatch between how willing people are to impose punishments/rewards and their *expectations* about how willing people are to impose punishments/rewards.

Fourth, the presence of cheap-talk messages affects choice behavior across genders differentially. Males typically invest more than females in the investment game. However, this is not the case in the presence of a cheap-talk message (whether in an implicit contract, or a low incentive contract). These differences do re-emerge in high incentive contexts, but it is not because females are less trusting but because males become *hyper*-trusting, investing much more than they do in any other treatment. Similarly, females tend to return more as agents in the investment game than their male counterparts. This result disappears in the presence of cheap-talk messages, whether the contract is implicit or incentive based. Cheap-talk contracts differentially affect the choice behavior of males and females, and yet (with the exception of T) the *content* of those contracts is no different across genders. And where they do differ (in TRUST), it is females asking for significantly less.

5 Conclusion

One of the main goals of this paper has been to address, using laboratory methods, the Paradox of Organizational Trust. There is no evidence that motivating a worker solely by trusting him (*a la* Hank Scorpio) is more efficient than wielding a Carrot or a Stick or a cat o' nine tails (*a la* Monty Burns). Indeed, in high-incentive contexts—those in which it is relatively cheap for a principal to deliver a large punishment or reward—quite the opposite is true, but the *level* of incentive is crucial.

More generally, the goal has been to explore the behavioral foundations for efficient solutions to principal–agent contracting problems, and to better understand how institutional structure interacts with those solutions. Further experimental probes are needed to better understand some of the findings reported here. For instance, we have simplified the environments considerably by allowing punishments *only*, or by allowing rewards *only*. In future experiments this assumption is relaxed in contracting environments with the ability to do either at the principal's discretion.[21] Since many principal–agent problems are repeated interactions, it will also be interesting to see what effect that may have on behavior in these games. The goal is to use the laboratory as a controlled probe, collecting information on very specific behavioral variables in principal–agent contracting games in order to constrain developing theory.[22] In this respect, the project is no different from any project in behavioral game theory.

[21] Andreoni, Harbaugh, and Vesterlund (2003) find such a mechanism in the proposer–responder game to induce the greatest move toward efficiency.

[22] See Healy (2004) for an experimentally-driven theory of behavior in efficiency wage games.

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A Instructions for Baseline

You have been asked to participate in an economics experiment. Now that the experiment has started, we ask that you do not talk during the experiment.

Experiment Description

In this experiment each of you will be paired with another individual, your counterpart for the experiment. You will not be told who this person is either during or after the experiment. Each person has received a $10 show-up fee. Each of you will be randomly selected to either be a first mover or a second mover; therefore, half of the people in today's experiment will be first movers and the other half will be second movers.

There are two stages. In the first stage, the first mover is allocated an additional $10. Each first mover will have the opportunity to send any part of this $10 (from $0 to $10) to their counterpart, a second mover. Each dollar sent will be tripled. Here are two examples: if a first mover sends $2, the second mover will receive $6; if a first mover, sends $9, the second mover will receive $27. These are only examples—the actual decision is up to each first mover. Along with any amount sent, the first mover will also propose a division of the tripled amount ($x, $y), where $x is the amount to be returned to the first mover and $y is the amount to be kept by the second mover.

In the second stage, the second mover has the opportunity to accept or reject the amount sent. If he/she rejects, the first mover earns $20 and second mover earns their $10 show-up fee. If he/she accepts, then the second mover has a decision to make: how much of the money to send back to the first mover and how much to keep. The amount of money the second mover returns to the first mover can be the same or different from the proposed division. Once the second mover decides, the first mover will learn of the decision.

THE EXPERIMENT IS THEN OVER.

Complete Privacy

Today's experiment is structured so that no one, neither the experimenter nor the other people in the experiment, nor anyone else, will ever know the personal decisions of anyone in the experiment. Before the experiment begins, you will select a blank envelope containing a code.

Once the experiment begins, you should enter the code into your computer, and then click the "OK" button. Be sure to place the code back in the envelope! At the end of the experiment, you will walk one by one and slide the envelope containing your code under the door. We will then look up your code, place your experiment earnings in the envelope, and slide it back under the door.

Since your decision is private, we ask that you do not tell anyone your decision either during, or after, the experiment.

Are there any questions before we begin?

B Instructions for Treatment Conditions

The instructions for the four treatment conditions contains the description below of the additional, third stage. The instructions are for Low Reward [High Reward]. The Punish conditions' instructions are exactly the same, except "*equal* or *greater* than" is replaced with "strictly *lower*".

In the third stage, if the amount of money the second mover returns to the first mover is *equal* or *greater* than the amount proposed by the first mover in the first stage, the first mover must decide to do **one** of the following:

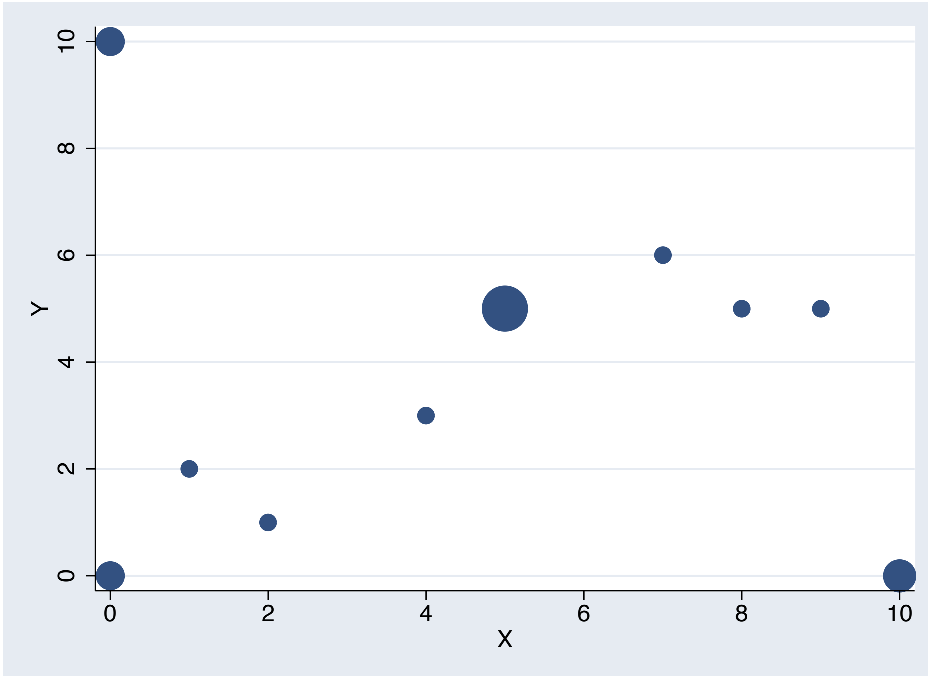
1. Make no change to the second mover's earnings, in which case the first mover's and the second mover's earnings are the same as those in the second stage.

2. Increase the earnings of the second mover, in which case the second mover's earnings increase by $1 [$3] for every $1 increase chosen by the first mover.

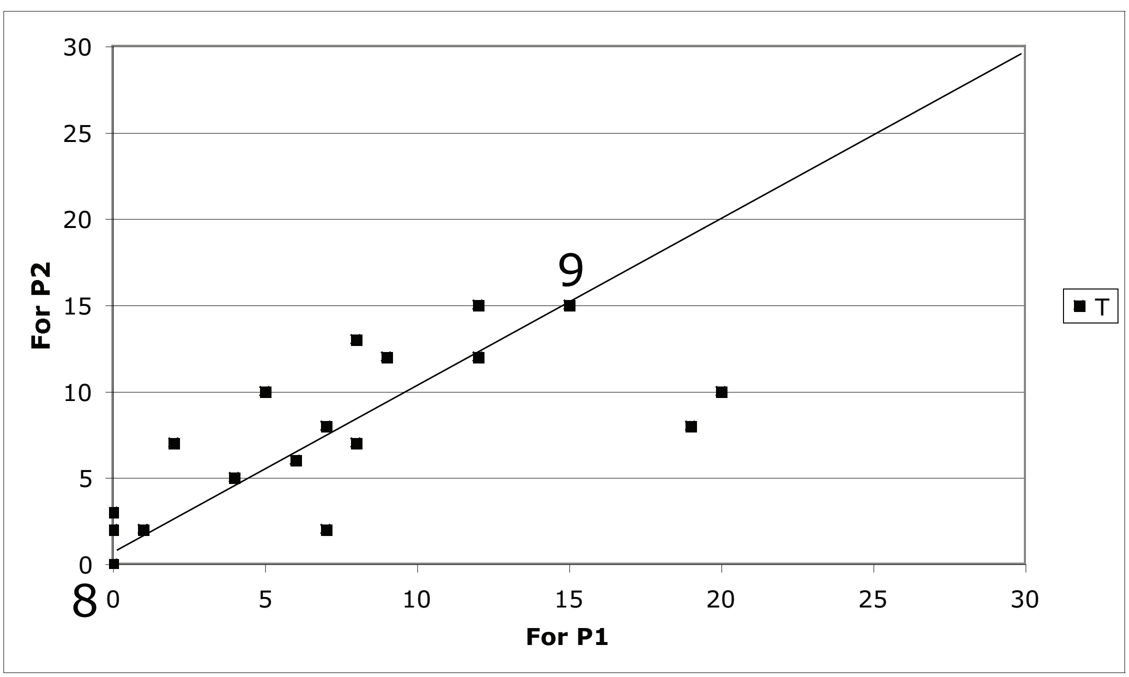
Note that if the first mover chooses to increase the earnings of the second mover, it costs the first mover $1 for every $1 [$3] change that he/she makes to the second mover's earnings. It does not cost the first mover anything to make no change to the second mover's earnings. The second mover will then learn of the first mover's decision.

C Figures for Desired Distribution of Gains from Exchange

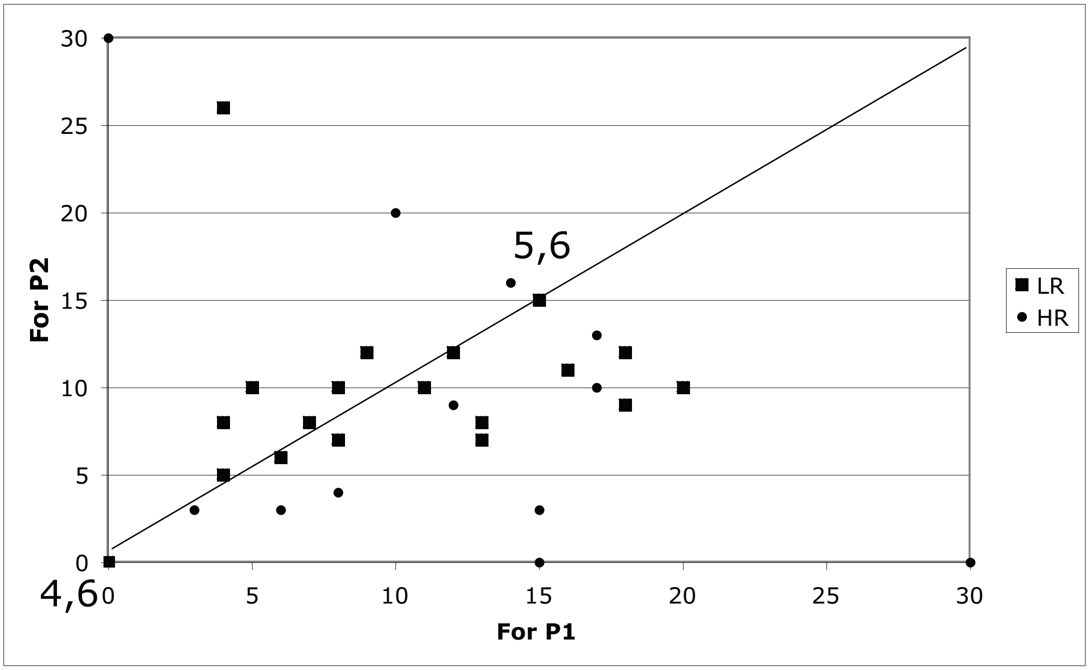
Appendix C contains the distributions of the cheap-talk messages P1s sent to P2, $(Z, 3X - Z)$. Notice that under Trust much of the distribution has messages favoring P2, i.e. those that lie above the 45-degree line. Under the Reward treatments, much of the distribution has messages that favor P1, i.e. those that lie below the 45-degree line. An interesting data point that does not possess this feature is under High Reward: P1 sent all \$10 and requested P2 keep all of the gains from exchange; P2 responded by sending it all back to P1 and P1 chose $c = \$8$, resulting in P2 being rewarded with $\rho = \$24$ for final earnings of \$32 for P1 and \$34 for P2. Under the punish treatments, much of the distribution lies around the 45-degree line, and in particular the majority of the offers are the equal split of (\$15, \$15).

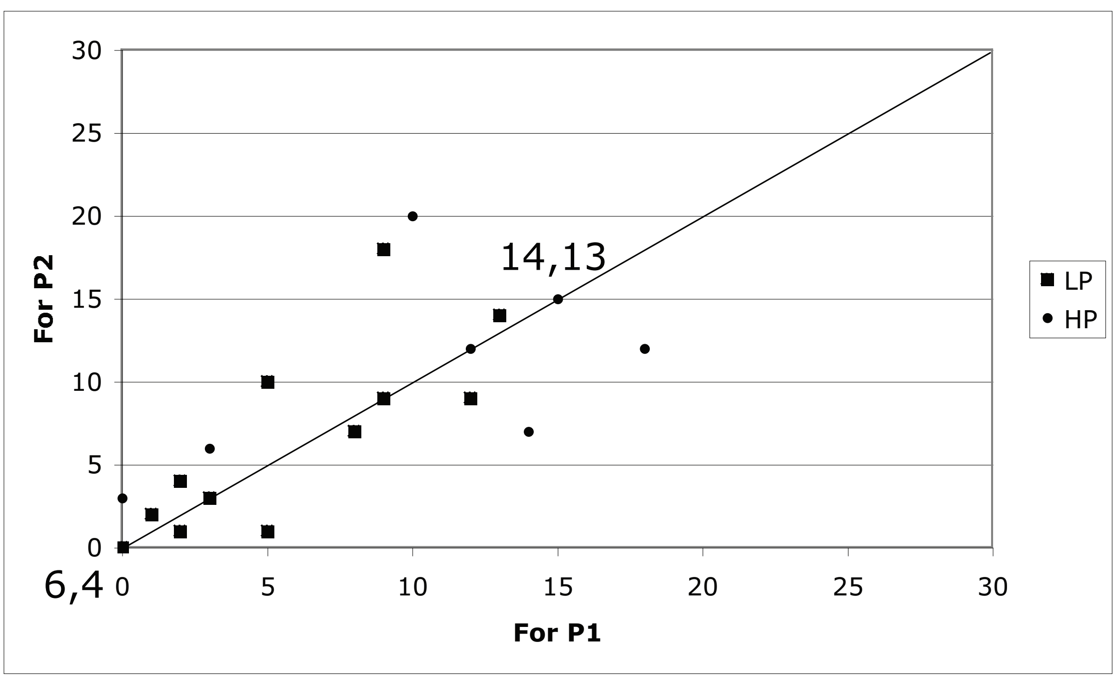


Y
X



For P2
For P1
9
8
T


For P2
For P1
LR
HR
5,6
4,6
0 5 10 15 20 25 30
0 5 10 15 20 25 30


For P2
For P1
LP
HP
14,13
6,4
0 5 10 15 20 25 30
0 5 10 15 20 25 30